The Case for Connectivity

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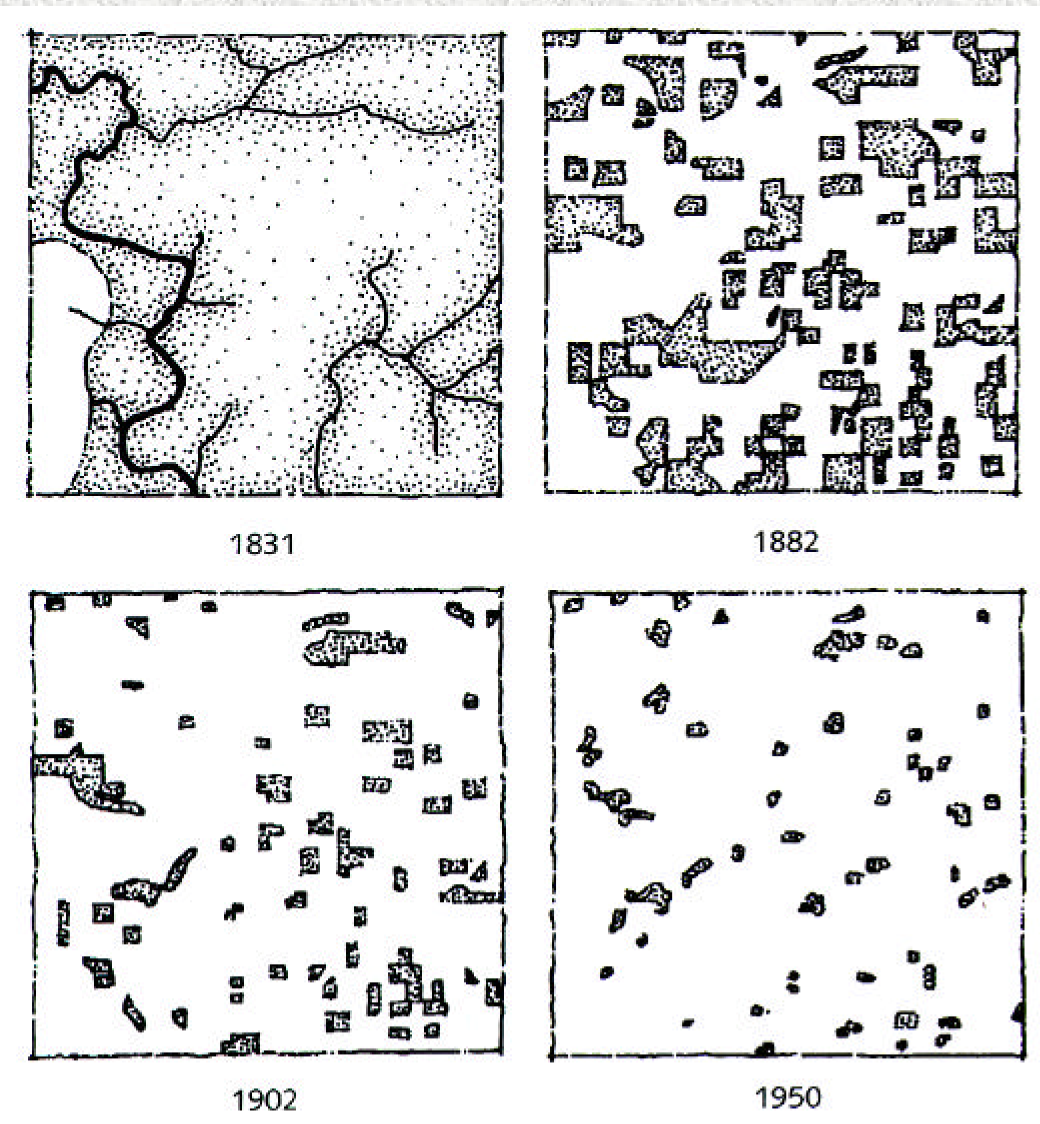
Habitat Fragmentation

- A reduction in patch area
- Increasing isolation of remaining habitat patches



(From Curtis, 1956)

Habitat Fragmentation

“Habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis.” (Wilcox and Murphy 1985)

Landscape Ecology

•Emphasizes broad spatial scales and the interactions between spatial patterns and ecological processes.

• “In land use decisions and actions, it is unethical to evaluate an area in isolation from its surrounding or from its development over time. Ethics impel us to consider an area in its broadest spatial and temporal perspectives.”

Forman 1987

• “Managed landscapes must incorporate natural levels of spatial and temporal heterogeneity while minimizing the negative effects of artificial edges and barriers.”

Harris, Hoctor, Gergel 1996

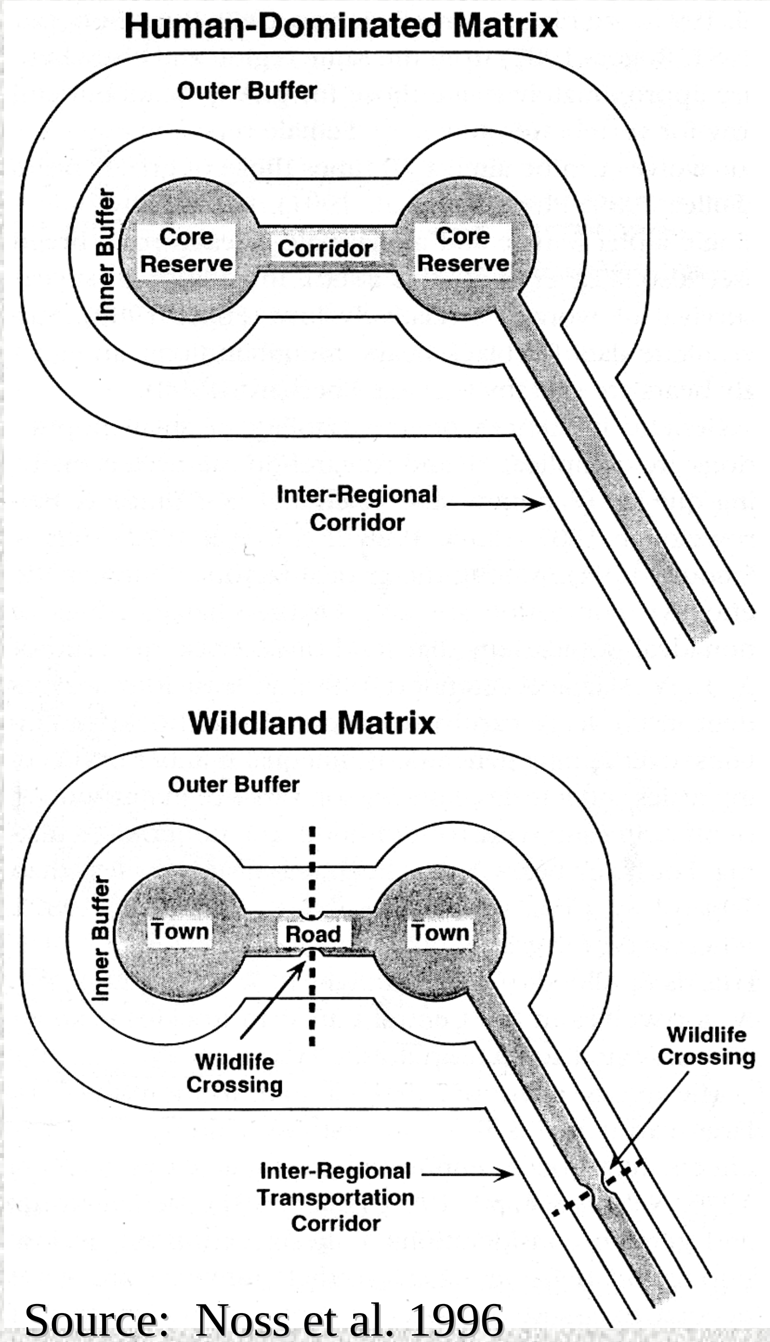
A Regional Landscape Approach to Conservation

- A conservation strategy that recognizes the importance of interactions between the built environment, rural lands, and native ecosystems and incorporates research, planning, and management at appropriately large spatial and temporal scales so that land uses are effectively integrated to maximize compatibility and ensure the conservation of biological diversity and other natural resources.

The “Pillars” of Reserve Design

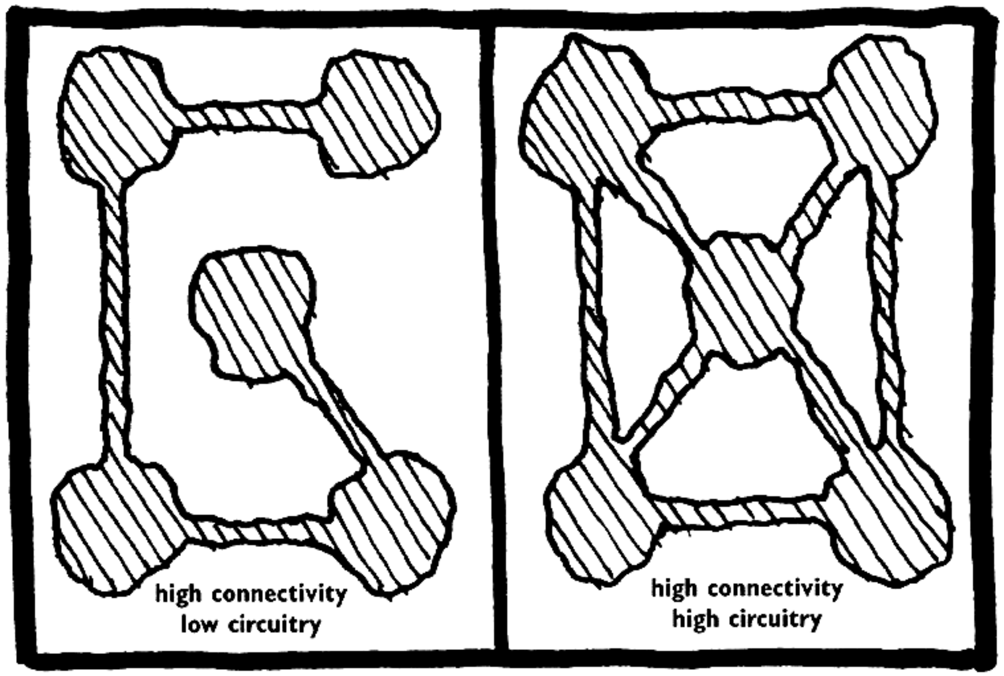
- Special elements
- Representation analysis
- Consideration of area sensitive species
- Consideration of ecological processes
- Connectivity and buffering

MODEL ECOLOGICAL NETWORKS



Source: Noss et al. 1996

The Value of Network Connectivity



M1. Network connectivity and circuitry

Network connectivity (i.e., the degree to which all nodes are linked by corridors), combined with network circuitry (i.e., the degree to which loops or alternate routes are present), indicates how simple or complex a network is, and provides an overall index of the effectiveness of linkages for species movement.

From: Dramstad et al. 1997

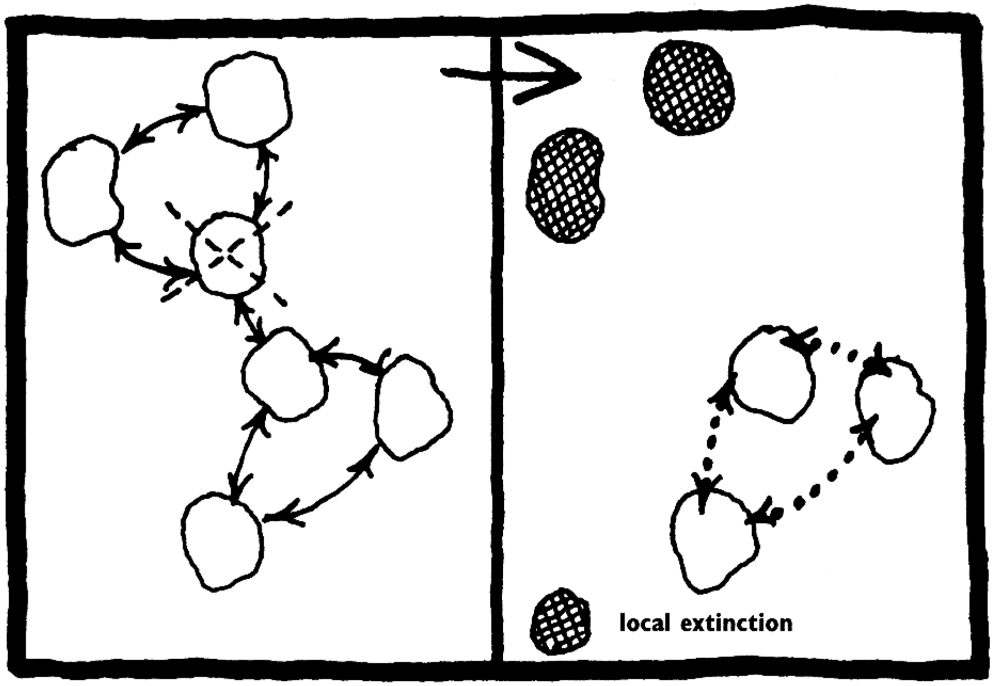
Metapopulations

- Metapopulation: a population that is a set of spatially separated subpopulations linked by dispersal (Wiens 1997).
- “Many still existing rare and endangered species are already ‘living dead,’ committed to extinction because extinction is the equilibrium toward which their metapopulations are moving in the current fragmented landscape.” (Hanski 1997)

Metapopulations and Patch Dynamics

P10. Metapopulation dynamics

Removal of a patch reduces the size of a metapopulation (i.e., an interacting population subdivided among different patches), thereby increasing the probability of local within-patch extinctions, slowing down the recolonization process, and reducing stability of the meta-population.



From: Dramstad et al. 1997

Connectivity vs. Fragmentation

"Connectivity is in many respects the opposite of fragmentation. A reserve system with high connectivity is one where individual reserves are functionally united into a whole that is greater than the sum of its parts." (Noss 1992)

Proposed Florida Regional Reserve Network (1985)

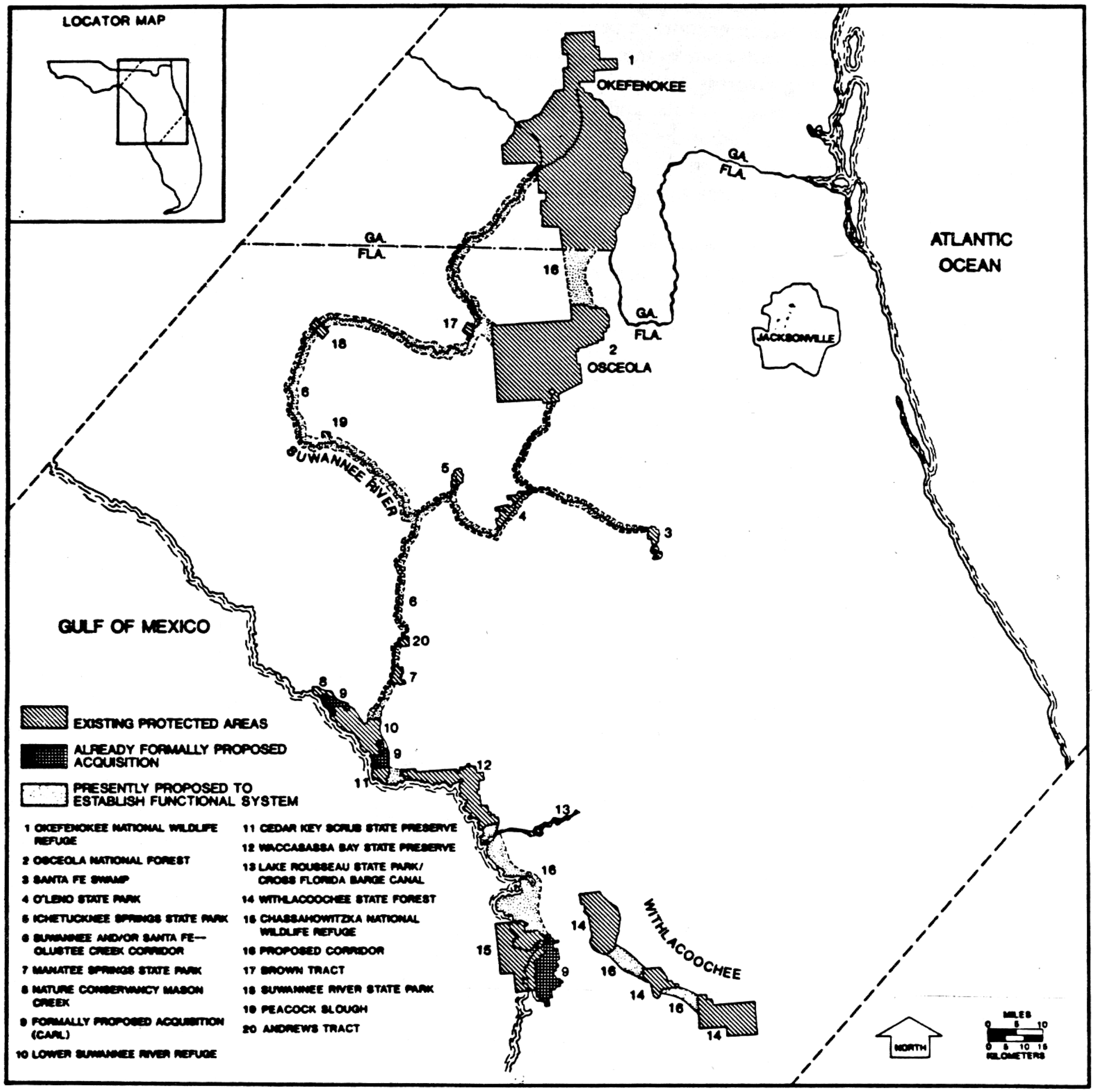
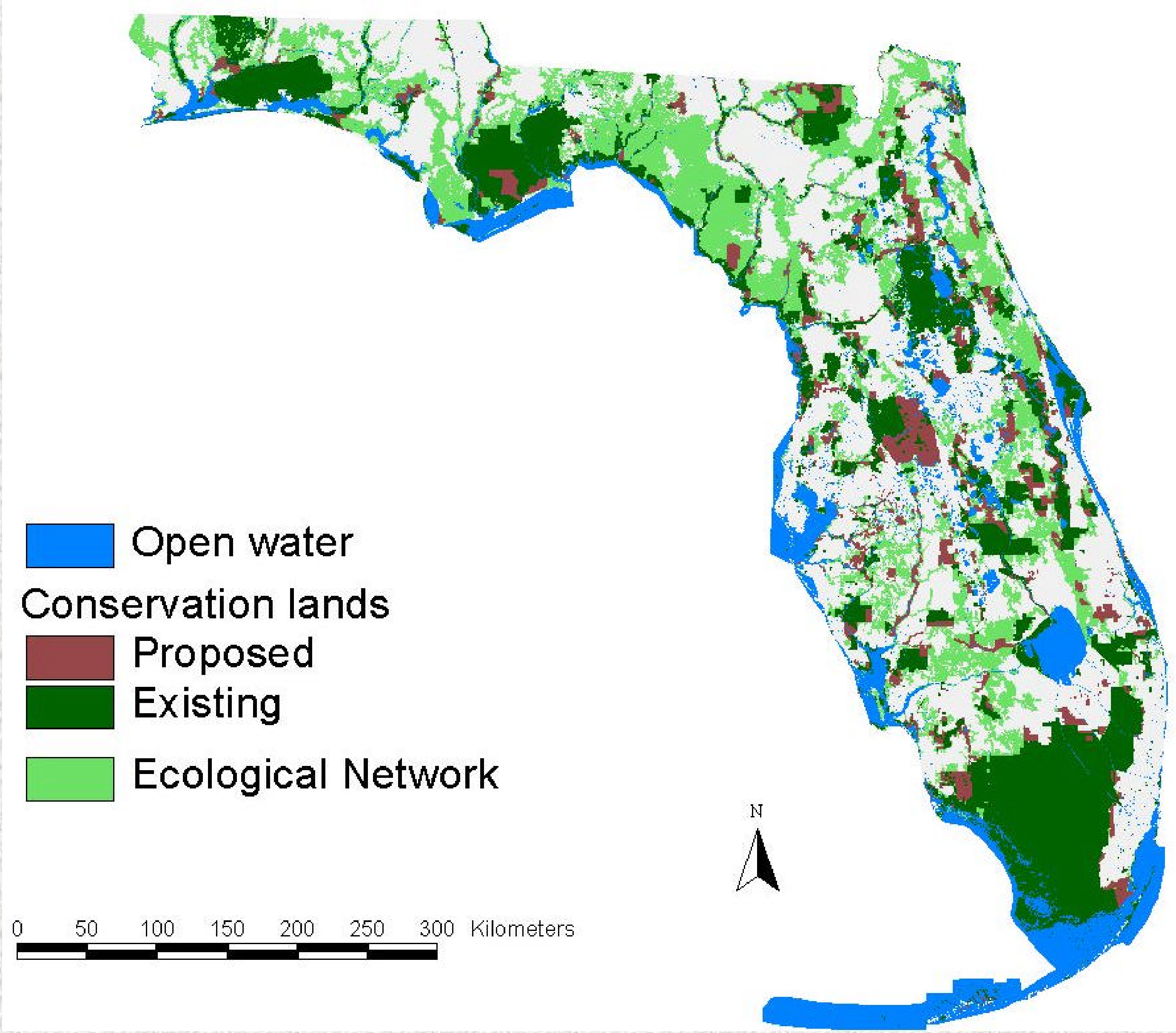
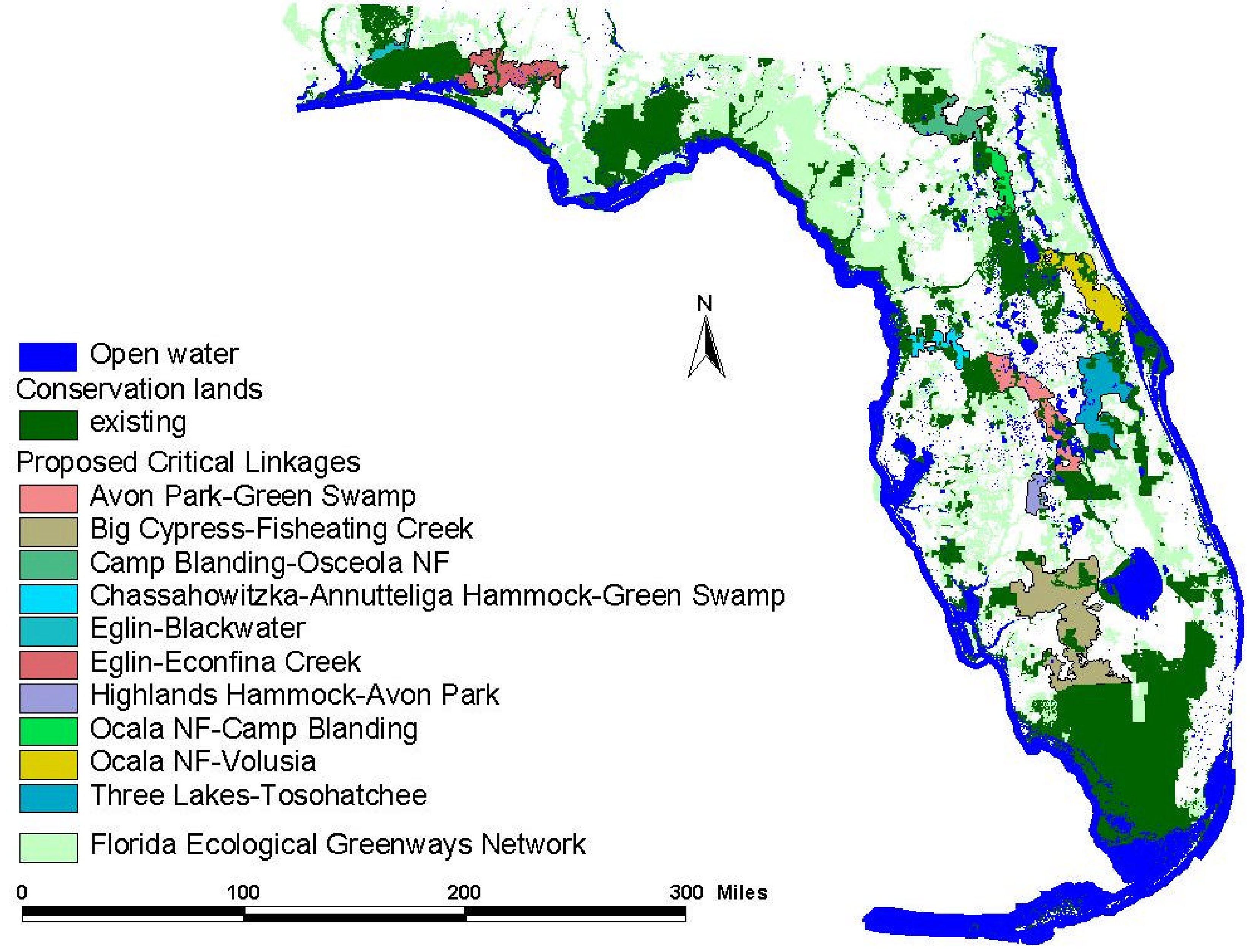


Figure 1. An example of a MUM network: a regional system of protected areas in north Florida and south Georgia, integrated by riparian and coastal corridors. From Harris and Noss 1985.

UF Ecological Network



Proposed Critical Linkages



Florida Forever Biodiversity Goals

GOAL D: Increase the protection of Florida's biodiversity at the species, natural community, and landscape levels.

Measure D1: Acres of significant Strategic Habitat Conservation Areas (identified by FWCC) acquired through fee simple or alternatives to fee simple.

Measure D2: Acres of highest priority conservation areas for Florida's rarest species and communities (identified in the conservation plan developed by FNAI and cooperating partners).

Measure D3: Acres of significant landscapes linkages and conservation corridors (identified by the Florida Greenways Project).

Measure D4: Acres of under-represented native ecosystems (identified by DEP), expressed as a percentage of the cumulative total of the original acres of the identified under-represented native ecosystems.

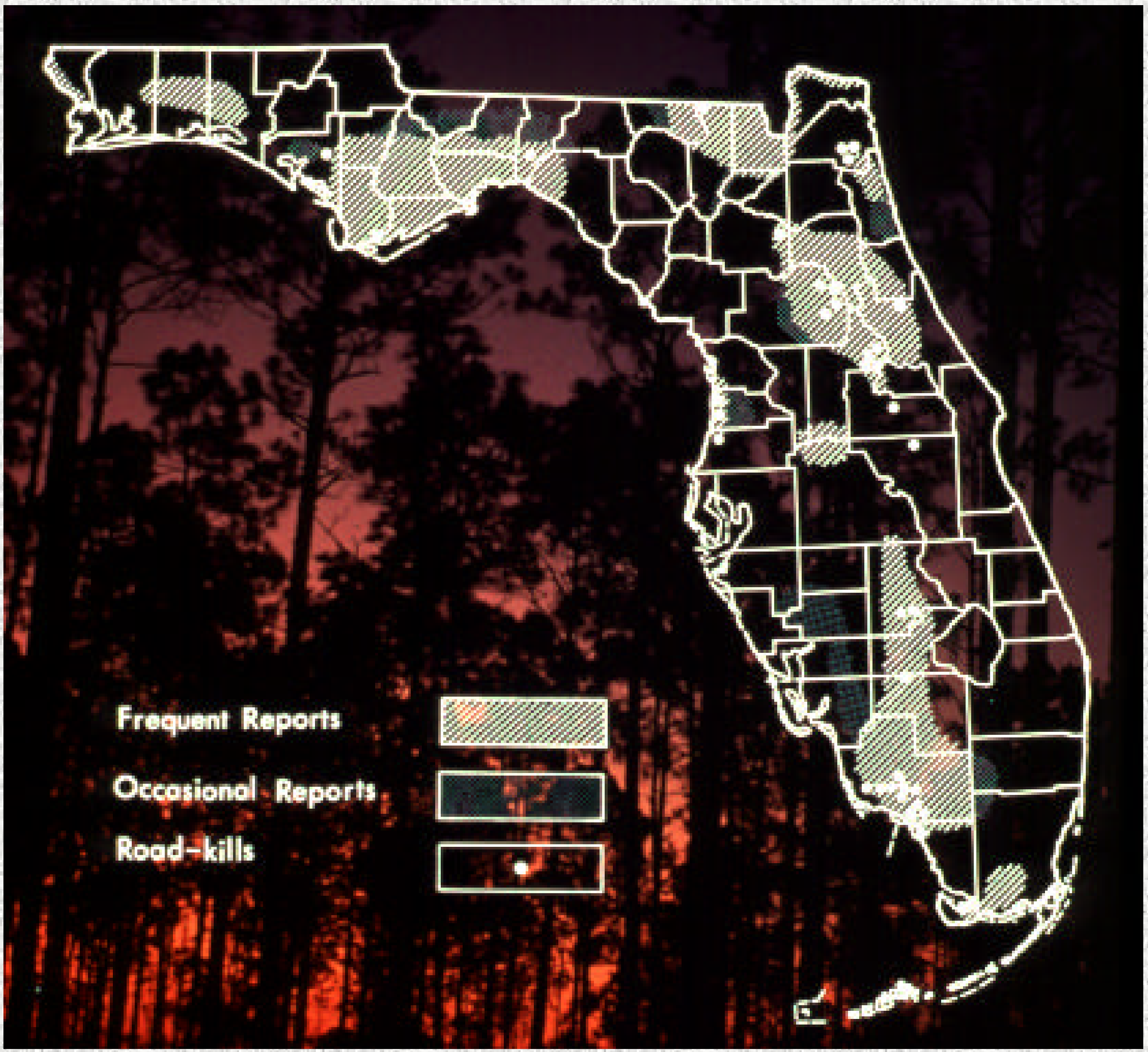
Measure D5: Number of landscape-sized protection areas ($\geq$50,000 acres) established through new acquisition projects, or augmentations to previous projects.

Corridor and Landscape Linkage Functions for Biodiversity

- Provide habitat and functional habitat gradients
- Facilitate daily through seasonal movements
- Facilitate dispersal movements, especially for wide-ranging species (to promote metapopulation stability and genetic integrity)
- Allowing spatial responses to disturbance
- Provide potential linkages for range shifts
- In riparian corridors, maintain functional hydrological processes

Conserving and Restoring large, wide ranging-species

Florida Black Bear Populations



Protecting Functional Habitat Juxtapositions

Longleaf Pine Forests
less than 10% remaining

Bottomland Hardwoods

Study traces tree deaths to sea-level rise

The Associated Press

A 1992 aerial photo shows dead trees on a salt marsh island surrounding surviving cabbage palms in the Waccasassa Bay State Preserve in Levy County on Florida's Gulf Coast. A seven-year University of Florida study shows rising sea levels are the cause behind the dying trees.

■ The change exposes the trees to damaging salt water.

By BRIAN GELLER
Sun staff writer

Opening a photo album, Francis Putz turns to the images of dead trees.

Newspaper clippings and overhead black and white pictures show it: cabbage palm and cedar tree stands dying at Waccasassa Bay.

"We're losing these areas too rapidly," said Putz, a University of Florida botany professor.

Complaints about death in the once-thriving stands brought researchers to the area in the early 1990s. And after years of research, the team now believes that increased saltwater exposure caused by rising sea levels is the culprit in the deaths.

And global warming, Putz says, is speeding up the sea-level rise.

Five scientists worked on the tree study, which was published in the September issue of Ecology. After launching the project seven years ago, researchers divided forested islands with differing elevations into 400-square-meter plots.

Putz said many of the people who complained about the dying trees had not noticed that the seedlings had been dying for years before.

"These were the living dead," he said. "There was no regeneration."

In fact, one of the study's main findings was that the stands suffer the effects of rising seas before the death of the canopy makes those effects obvious, said Kimberlyn Williams, a former UF assistant professor of botany.

TREES continued on Page 8A

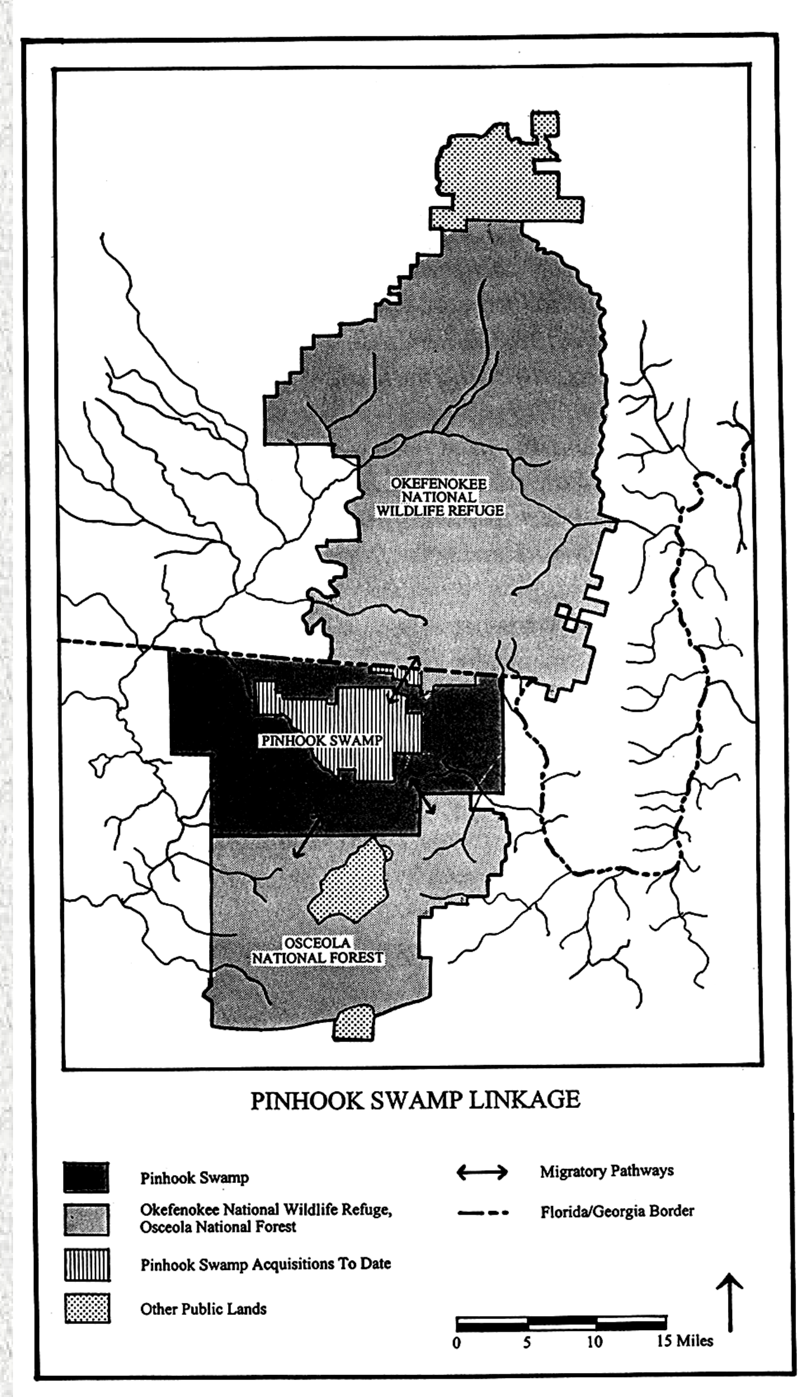
Gainesville Sun
October 20, 1999

Wildlife Corridor Definitions

- A swath of habitat through which non-domesticated organisms may move. (Noss 1993)
- A naturally existing or restored native linear landscape feature that connects two or more larger tracts of essentially similar habitat and functions as either a movement route for individuals or an avenue for gene-flow among native flora and fauna. (Harris and Sheck 1991)

Landscape Linkages

Areas of habitat sufficiently wide and connected to both support populations of species of conservation interest while providing connectivity to other large blocks of habitat.



Stream Corridors: Connectivity and Ecosystem Services

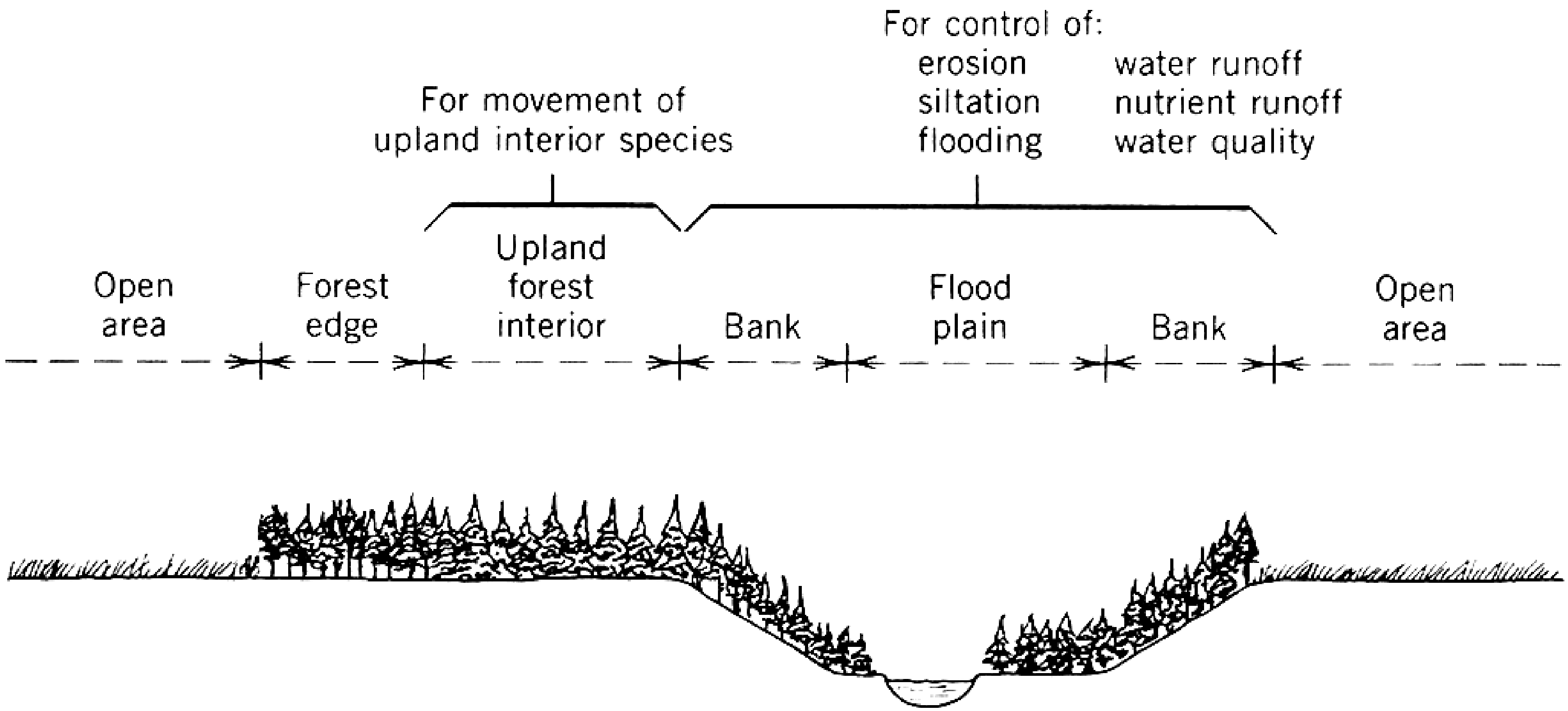


Figure 4.13 *Structure and functions of a stream corridor. From Forman (1983). (Courtesy of* Ekologia CSSR.*)*

From: Forman and Godron 1985

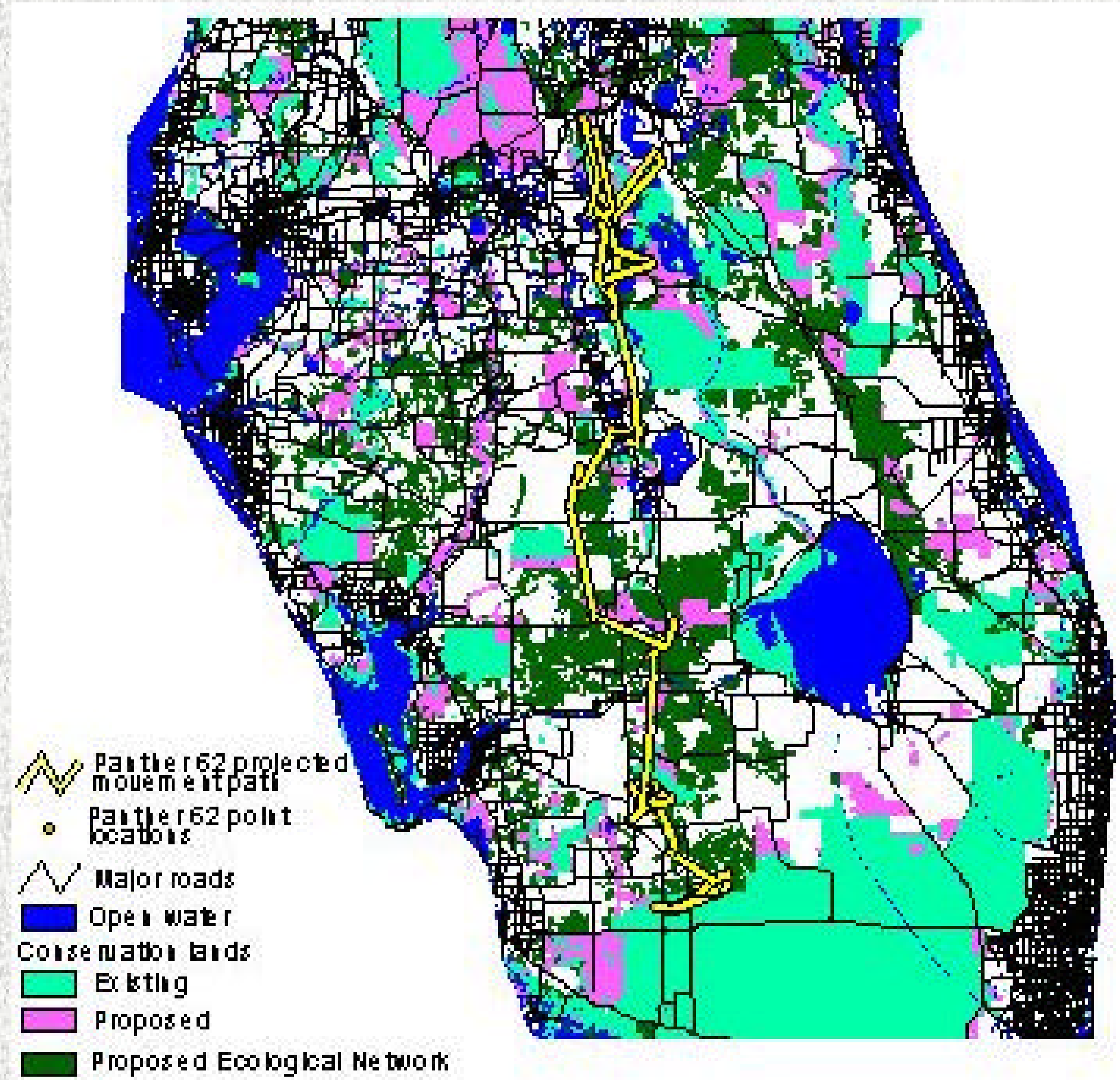
Corridor Widths Delineated

- At the landscape scale, attempt to protect corridors at least 3 times the width of edge effects.
- At the regional scale (app. Greater than 10 miles long) corridors should average 1 mile wide (Noss 1993). Consider a 1 to 10 rule as distance increases.

Functional Corridor Characteristics for Cougars

- Located along natural travel routes (including riparian strips and ridges)
- Have ample woody cover
- Include underpasses with ample fencing at large/high-speed road crossings
- Lack artificial outdoor lighting
- Have less than 1 human dwelling/16 hectares (app. 40 acres)
- width: >100 m if < 800 m long; >400 m if 1-7 km

Panther 62 Movements and the Ecological Network



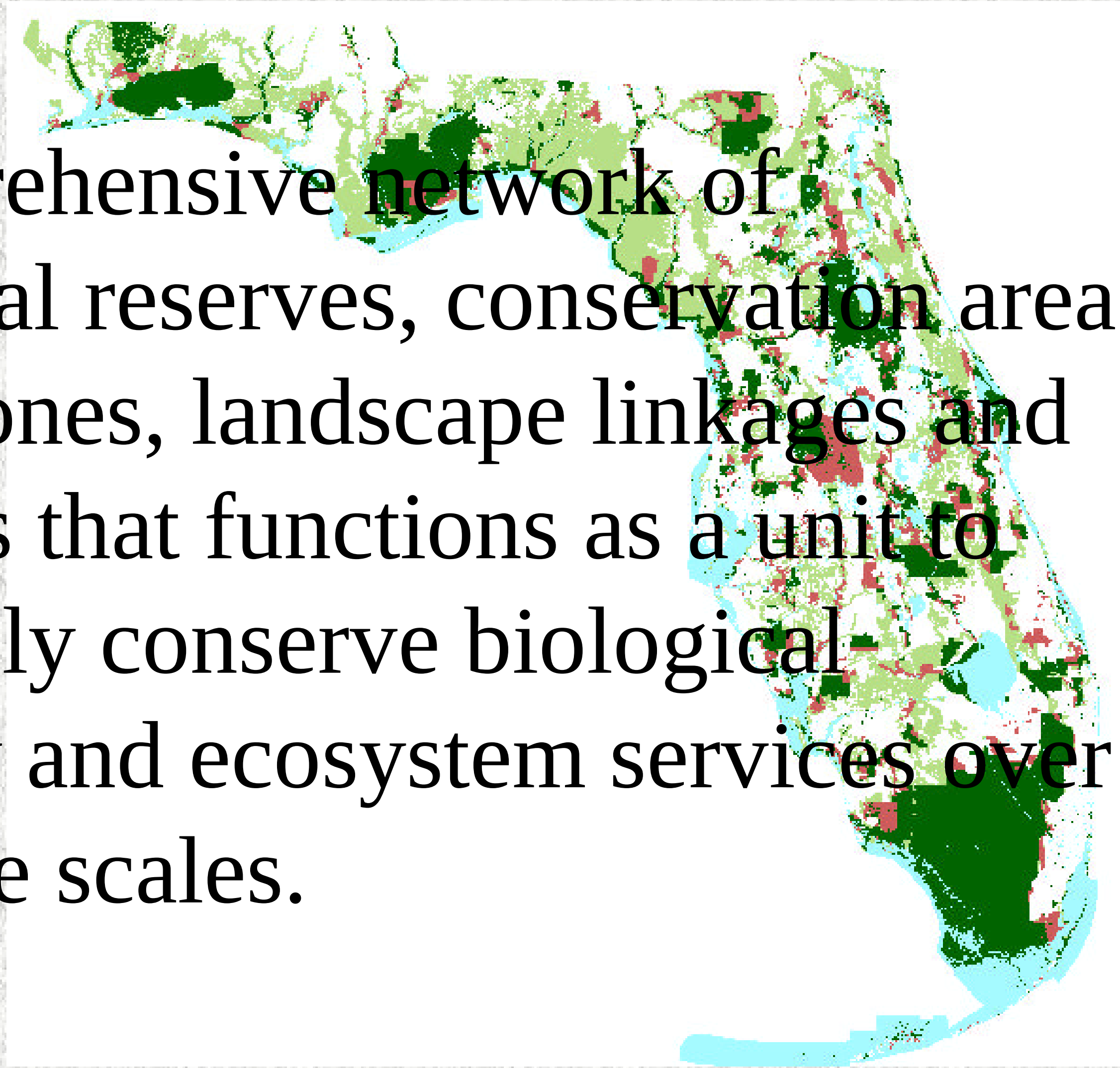
Arguments against Corridors

- high perimeter to area ratio so potentially subject to negative edge effects
- exotic species, “weedy” species, disturbances, or disease could move through corridor
- could serve as a trap for target species
- lack of empirical evidence of corridor function or, in other words, dearth of knowledge about the characteristics of functional corridors for particular species
- Trade-offs: Protect high quality habitat or corridors?

Corridors as Part of an Integrated Approach

- Wildlife corridors and greenways are no panacea. “Rather, they must be seen as one element of an integrated landscape conservation strategy necessary to maintain the many values of natural ecosystems.” (Noss 1993)
- “ Do not allow corridors to substitute for the protection of large, intact core reserves or to divert attention from managing the landscape as a whole in an ecologically responsible manner.” (Noss 1992)

Integrated Ecological Conservation System



A comprehensive network of ecological reserves, conservation areas, buffer zones, landscape linkages and corridors that functions as a unit to effectively conserve biological diversity and ecosystem services over long time scales.